CLAIMS

We claim:

1. An ultraviolet disinfection (UV) system for treating waste-containing fluid, the system comprising at least one light source positioned within a housing and connected to a power source for producing a UV light output from the housing, the system including at least one optical component positioned between the at least one light source and the UV light output from the housing, thereby producing a focused, controllable UV light output that has at least one UV dose zone for providing effective sterilization of microorganisms within the fluid.

2. The UV system according to claim 1, wherein the at least one UV light source is one lamp.

3. The UV system according to claim 1, wherein the at least one UV light source is a UV lamp.

4. The UV system according to claim 3, wherein the at least one UV light source is a spectral calibration lamp.

5. The UV system according to claim 3, wherein the at least one UV light source is an electrodeless lamp.

6. The UV system according to claim 3, wherein the at least one UV light source is a mercury halide lamp.

7. The UV system according to claim 1, wherein the at least one UV light source is a light pump device.

8. The UV system according to claim 7, wherein the output from the at least one UV light source is distributed by fiber optic transmission lines.

9. The UV system according to claim 7 wherein the fiber optic transmission lines having a first end connected to the housing output such that the UV light output from the housing passes through the fiber optic transmission lines and exiting from a second end such that the UV light output exiting the fiber optic transmission lines is projected into the water.

10. The UV system according to claim 8, wherein the fiberoptic lines include acrylic fibers.

11. The UV system according to claim 8, wherein the fiberoptic lines include glass fibers.

12. The UV system according to claim 8, wherein the fiberoptic lines include liquid core fibers.

13. The UV system according to claim 8, wherein the fiberoptic lines include hollow core fibers.

14. The UV system according to claim 8, wherein the fiberoptic lines include core-sheath fibers.

15. The UV system according to claim 8, wherein at least one fluid-containing device is connected to the light pump device via fiberoptic transmission lines.

16. The UV system according to claim 1, further including a non-fouling lamp housing thereby eliminating cleaning of the lamp housing to ensure consistent UV disinfection of the fluid.

17. The UV system according to claim 1, wherein the light housing is affixed to a reservoir and the UV light output disinfects a substantially non-flowing water supply contained within the reservoir.

18. The UV system according to claim 17, wherein the system has a non-vertical riser configuration.

19. The UV system according to claim 1, wherein the lamp housing is affixed to a reservoir with flowing water contained therein.

20. The UV system according to claim 2, further including a vertical riser configuration (VRC) wherein the water is moved at a predetermined rate toward the UV light output thereby producing an increasing UV dose within the water as it approaches the light output.

21. The UV system according to claim 20, wherein the interface zone further includes at least one additive that influence characteristics of the fluid as the fluid passes through the interface zone and over the surface zone.

22. The UV system according to claim 21, wherein the at least one additive is selected from the group consisting of TiO2, WO2, ZnO, ZnS, SnO2, and $PtTiO_2$ and the like.

23. The UV system according to claim 20, wherein the vertical riser configuration system is portable.

24. The UV system according to claim 20, wherein the vertical riser configuration system is scalable to applications.

25. The UV system according to claim 20, wherein the system is adaptable to be removably connected to a piping system for carrying water to an end user output, such that a multiplicity of systems may be positioned to function at a corresponding multiplicity of end user outputs to provide disinfected, purified water in many locations at once.

26. The UV system according to claim 1, wherein the at least one optical component is selected from the group consisting of reflectors, shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides, homogenizer, mixing rods, manifolds and other couplers, filters, gratings, diffracters, color wheels and fiber optic transmission lines.

27. The UV system according to claim 1, wherein at least one optical component is an off-axis optical component.

28. The UV system according to claim 1, wherein at least one optical component is a gradient component.

29. The UV system according to claim 1, wherein at least one optical component is UV transmissive.

30. The UV system according to claim 1, wherein at least one optical component is UV reflective.

31. The UV system according to claim 1 wherein the at least one optical component includes fiber optic transmission lines having a first end connected to the housing output such that the UV light output from the housing passes through the fiber optic transmission lines and exiting from a second end such that the UV light output exiting the fiber optic transmission lines is projected into the water.

32. The UV system according to claim 26, wherein the at least one optical component is a lens for focusing light from the light source through an output point in the housing and into the water for disinfection thereof.

33. The UV system according to claim 32, wherein the lens is a parabolic lens.

34. The UV system according to claim 1, wherein the at least one UV dose zone includes a water-air interface dose zone and a variable intra-fluid dose zone.

35. The UV system according to claim 1, wherein the at least one UV light source is positioned outside the water to be treated thereby providing effective sterilization of microorganisms within the water.

36. An ultraviolet disinfection (UV) system for treating waste-containing fluid, the system comprising at least one light source positioned outside the fluid to be treated and positioned within a housing and connected to a power source for producing a UV light output from the housing, the system including at least one optical component positioned between the at least one light source and the UV light output from the housing, thereby producing a focused, controllable UV light output that has at least one UV dose zone for providing effective sterilization of microorganisms within the fluid.

37. The UV system according to claim 36, wherein the at least one UV light source is a single UV lamp.

38. The UV system according to claim 36, wherein the at least one UV light source is a spectral calibration lamp.

39. The UV system according to claim 36, wherein the at least one UV light source is an electrodeless lamp.

40. The UV system according to claim 36, wherein the at least one UV light source is a mercury halide lamp.

41. The UV system according to claim 36, wherein the at least one UV light source is a light pump device.

42. The UV system according to claim 36, wherein the at least one UV light source is a pulsed lamp device.

43. The UV system according to claim 36, further including a non-fouling lamp housing thereby eliminating cleaning of the lamp housing to ensure consistent UV disinfection of the fluid.

44. The UV system according to claim 36, wherein the light housing is affixed to a reservoir and the UV light output disinfects a substantially non-flowing water supply contained within the reservoir.

45. The UV system according to claim 44, wherein the system has a non-vertical riser configuration.

46. The UV system according to claim 36, wherein the lamp housing is affixed to a reservoir with flowing water contained therein.

Sub A7 47. The UV system according to claim 36, further including a vertical riser configuration (VRC) wherein the water is moved at a predetermined rate toward the UV light output thereby producing an increasing UV dose within the water as it approaches the light output.

Sub A2 48. The UV system according to claim 36, wherein the interface zone further includes at least one additive that influence characteristics of the fluid as the fluid passes through the interface zone and over the surface zone.

49. The UV system according to claim 48, wherein the at least one additive is selected from the group consisting of TiO_2, WO_2, ZnO, ZnS, SnO_2, and $PtTiO_2$ and the like.

50. The UV system according to claim 47, wherein the vertical riser configuration system is scalable to applications.

50. 51. The UV system according to claim 46, wherein the system is adaptable to be removably connected to a piping system for carrying water to an end user output, such that a multiplicity of systems may be positioned to function at a corresponding multiplicity of end user outputs to provide disinfected, purified water in many locations at once.

51. 52. The UV system according to claim 36, wherein the at least one optical component is selected from the group consisting of reflectors, shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides, homogenizer, mixing rods, manifolds and other couplers, filters, gratings, diffracters, color wheels and fiber optic transmission lines.

52. 53. The UV system according to claim 36, wherein at least one optical component is UV transmissive.

53. 54. The UV system according to claim 36, wherein at least one optical component is UV reflective.

Del A8 55. The UV system according to claim 36, wherein the at least one optical component includes fiber optic transmission lines having a first end connected to the housing output such that the UV light output from the housing passes through the fiber optic transmission lines and exiting from a second end such that the UV light output exiting the fiber optic transmission lines is projected into the water.

55. 56. The UV system according to claim 54, wherein the fiberoptic lines include acrylic fibers.

56. 57. The UV system according to claim 55, wherein the fiberoptic lines include glass fibers.

57. 58. The UV system according to claim 55, wherein the fiberoptic lines include liquid core fibers.

58. 59. The UV system according to claim 55, wherein the fiberoptic lines include hollow core fibers.

59. 60. The UV system according to claim 55, wherein the fiberoptic lines include core-sheath fibers.

Sub A 9 61. The UV system according to claim 52, wherein the at least one optical component is a lens for focusing light from the light source through an output point in the housing and into the water for disinfection thereof.

61. 62. The UV system according to claim 61, wherein the lens is a parabolic lens.

62. 63. The UV system according to claim 36, wherein the at least one UV dose zone includes a water-air interface dose zone and a variable intra-fluid dose zone.

Sub A 10 64. A method for purifying waste-containing fluids comprising the steps of:

providing the fluid to be treated in a reservoir;

exposing the reservoir and fluid to a UV system including at least one light source positioned within a housing and connected to a power source for producing a UV light output from the housing, the system including at least one optical component positioned between the at least one light source and the UV light output from the housing;

producing a focused, controllable UV light output that has at least one UV dose zone for providing effective sterilization of microorganisms within the water.

64, 65. The method according to claim 63, wherein the system includes a non-submerged light source.

66. A method for providing ultraviolet disinfection (UV) of waste-containing fluids, the method comprising the steps of

providing a UV disinfection system comprising at least one UV light source coupled with at least one UV-transmissive optical component outside a fluid to be treated and at least one interface zone positioned between the at least one UV light source and the fluid to be treated, the at least one UV light source designed, configured, and connected to produce UV light creating at least one UV dose zone outside the fluid;

presenting a surface zone on the at least one interface zone, wherein the surface zone has a UV dose zone associated therewith for disinfecting the fluid to be treated;

introducing a pre-treated fluid into the system, the fluid passing through at least one UV dose zone within the fluid and passing through the at least one interface zone and surface zone UV dose zone;

disinfecting the fluid via exposure to the UV light in the UV dose zones;

dispensing the disinfected fluid outside the system.

67. The method according to claim 66, further including the step of forcing water via a hydraulic system through a vertical riser configuration of the system.

68. The method according to claim 66, further including the step of modifying the fluid characteristics via at least one additive on the interface zone causing a reaction in the fluid.

~~69~~. 68. The method according to claim ~~66~~ 65, further including the step of introducing turbulence in the fluid as the fluid passes throughout the system, thereby increasing the exposure to UV light, disinfection, and catalytic chemical reactions.

~~70~~. 69. The method according to claim ~~66~~ 65, further including the step of introducing a catalyst at the interface zone.